The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

PCT/GB03/5199

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 23 December 2003

FGS

020EC02 25-1 000314
P01/7700 0.00-0228011.3

THE PATENT OFFICE
A
- 2 DEC 2002
RECEIVED BY

The Patent Office

Patents Form 1/77

Patents Act 1977
(Rule 16)

1/77

The Patent Office

Cardiff Road
Newport
South Wales
NP9 1RH

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference — P/63798.GBA/VPOW

2. Patent application number *(The Patent Office will fill in this part)* — 0228011.3 — - 2 DEC 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

E2V Technologies Limited
106 Waterhouse Lane
Chelmsford
Essex
CM1 2QU

Patents ADP number *(if you know it)* 8457749001

If the applicant is a corporate body, give the Country/state of its incorporation — United Kingdom

4. Title of the invention — ELECTRON BEAM TUBES

5. Name of your agent *(if you have one)* — N. Hucker — REPPIE & GROSE

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Marconi Intellectual Property 16 THEOBALDS ROAD
Marconi House
The Vineyards
Great Baddow
Chelmsford
Essex CM2 7DS
LONDON
WC1X 8PL

Patents ADP number *(if you know it)* 8225247001 — GLOBAL 23/12/03

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form P1/77

0054251 02-Dec-02 02:00

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	(0)
Description	6
Claim(s)	2
Abstract	1
Drawings	2 only

10. If you are also filing any of the following, state how many against each item.

Priority documents	(0)
Translations of priority documents	(0)
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	(0)
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	(0)
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Nerys Hucker Date 02/12/02

12. Name and daytime telephone number of person to contact in the United Kingdom

Nerys Hucker
01245 493 493 ext.3122

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

ELECTRON BEAM TUBES

This invention relates to electron beam tubes, and particularly to linear beam devices.

Linear beam devices are employed in order to amplify signals at high frequencies by modulating an electron beam.

Examples of such devices are klystrons and Inductive Output Tubes (IOTs). Such devices are typically employed as the final stage of amplification in television transmitters at frequencies within the UHF range (470 to 800 MHz). A typical linear beam device comprises an electron gun for generating a beam of electrons, an RF interaction region, for example a series of drift tubes, where amplification of an RF signal takes place and a collector for dissipating the electron beam after it has left the RF interaction region. Amplification of the signal takes place within a vacuum envelope.

Such devices may be of the so-called external cavity type, in which the vacuum envelope comprises a plurality of ceramic cylinders attached to metal structures, for example mounting plates provided on drift tube assemblies.

A problem that may be encountered with such devices is that changes in temperature in the device can give rise to mechanical stress between components of the tube.

It has been proposed to alleviate such problems by the inclusion of so-called balance rings, usually of ceramic, which reduce such thermal stresses. However, it has been

found that, in certain conditions, even with the inclusion of balance rings, thermal stresses may be significant and may even cause damage to the ceramic walls defining the vacuum envelope.

The invention provides an electron beam tube having a longitudinal axis and comprising a first component, a second component and means arranged to allow relative sliding movement of the first component relative to the second component in a radial direction

The invention permits relative radial movement of components of the tube, in order to alleviate stress produced by differential thermal expansion between the components.

Preferably, the means arranged to produce relative sliding movement comprises a member interposed between the components. This arrangement maintains the integrity of the vacuum envelope.

The member may be annular, in order to correspond to the shape of the walls defining the vacuum envelope.

Advantageously, the means includes material arranged to reduce friction between the components.

One of the components may include a portion of the ceramic wall forming part of the vacuum envelope. The other component may be part of a drift tube, such as the mounting plate.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a partly sectional schematic side view of a prior art electron beam tube;

Figure 1a illustrates in more detail the portion of Figure 1 circled by a broken line;

Figure 2 is a partly sectional side view of an electron beam tube constructed according to the invention; and

Figure 2a illustrates in more detail the portion of Figure 2 circled by a broken line.

Like reference numerals refer to like parts throughout the specification.

Figures 1 and 1a illustrate part of a conventional electron beam tube, indicated generally by the reference numeral 1, the tube having a longitudinal axis 2. The part illustrated in these Figures generally comprises the RF interaction region for the tube incorporating a drift tube assembly. Only one side of the tube is shown in detail in Figure 1a, the components illustrated being approximately symmetrical about the longitudinal axis.

A mounting plate 3 for the drift tube is shown in Figure 1a. The mounting plate is typically of copper, stainless steel or nickel. A vacuum envelope 4 for the tube is partially defined by a cylindrical wall 5 of RF transparent material, such as alumina. The cylindrical wall 5 is substantially coaxial with the longitudinal axis 2. The mounting plate 3 also forms part of the vacuum envelope 4. The cylindrical wall 5 is attached to the drift tube mounting plate 3 in the following manner.

An end surface 6 of the wall 5 is metallised and attached by brazing to a flare 7, which is of metallic material such as cupro-nickel. The flare 7 has a portion 8 that abuts the end face of the wall 5, and a transverse portion 9 that may be coaxial with the longitudinal axis 2 of the tube.

The other side of the portion 8 of the flare 7 is attached to an end surface 10 of a ceramic balance ring 11 in a like fashion. The ceramic balance ring is coaxial with the wall 5. The other end surface 12 of the balance ring 11 is located in a recess 13 in the mounting plate 3.

The recess 13 also includes an end portion 14 of a second flare 15, the other end portion 16 of which is welded to the transverse portion 9 of the other flare 7.

The inclusion of the ceramic balance 11 ring helps to relieve thermal stresses in the assembly as the temperature of the tube 1 changes during operation. However, it has been found that, in certain circumstances where the temperature difference experienced

by the tube is greater than usual, thermally-induced mechanical stress can become unacceptably high.

A tube constructed in accordance with the invention is illustrated in Figures 2 and 2a, and is indicated generally by the reference numeral 17. This tube also comprises a cylindrical wall 5, attached to the mounting plate 3 of a drift tube assembly via the intermediary of a balance ring and flares 7, 15.

However, in accordance with the invention, the tube 17 further comprises means, such as member 18, arranged to allow small radial movement of the balance ring with respect to the mounting plate, in order to alleviate thermal stresses on the tube.

In this arrangement, the member 18 is annular and is substantially coaxial with the cylindrical wall 5. The member is interposed between a balance ring 19 and the mounting plate 3. The member 18 is located in the recess 13 of the mounting plate and is held in location by atmospheric forces acting upon the tube when the interior has been evacuated to produce a vacuum.

The member 18 comprises material arranged to provide reduced friction between the balance ring 19 and the mounting plate 3. Preferably, the member has a lower coefficient of friction than both the balance ring and the mounting plate. Alternatively, a member coated with or loaded with friction-reducing material may be provided. As a further alternative, a layer of friction-reducing material may be substituted for the

member 18. A plurality of friction-reducing members may be provided between the balance ring and the mounting plate.

The means arranged to allow radial movement of the balance ring with respect to the drift tube assembly may alternatively, or additionally, be interposed between other components of the tube, in order to further reduce stress experienced overall by the tube assembly. The invention has particular merits when the means is interposed between components having different coefficients of thermal expansion.

A tube assembly typically comprises a plurality of ceramic walls alternating with metallic structures, such as a plurality of drift tube assemblies. Therefore, a plurality of members 18, for example, may be located between each ceramic and metallic component to provide relative radial movement of those components.

The invention permits the balance ring to move radially in order to alleviate the forces caused by differential thermal expansion of components of the tube. The member moves in a sliding motion, thereby maintaining the integrity of the vacuum envelope. Thus, a tube constructed according to the invention can be operated under substantially more onerous conditions than were feasible hitherto.

CLAIMS

1. An electron beam tube having a longitudinal axis and comprising a first component, a second component and means arranged to allow relative sliding movement of the first component relative to the second component in a radial direction.

2. A tube as claimed in claim 1, in which the means comprises a member interposed between the first and second components.

3. A tube as claimed in claim 2, in which the member comprises an annulus.

4. A tube as claimed in claim 1, in which the means comprises a plurality of members interposed between the first and second components.

5. A tube as claimed in claim 4, in which each of the members comprises an annulus.

6. A tube as claimed in any preceding claim, in which the means includes material having a low coefficient of friction.

7. A tube as claimed in any preceding claim, in which one of the first and second components comprises a wall forming part of a vacuum envelope.

8. A tube as claimed in claim 7, in which the wall is of ceramic.

9. A tube as claimed in claim 7 or 8, in which the wall includes a balance ring.

10. A tube as claimed in any preceding claim, in which one of the first and second components comprises part of a drift tube assembly.

11. A tube as claimed in claim 10 in which the part is a mounting plate for the drift tube.

12. An electron beam tube having a longitudinal axis and comprising a drift tube assembly, a wall forming part of a vacuum envelope and means arranged to allow relative sliding movement of the drift tube assembly relative to the wall in a radial direction.

13. An electron beam tube, substantially as hereinbefore described, with reference to, or as illustrated in, Figures 2 and 2a of the accompanying drawings.

ABSTRACT

ELECTRON BEAM TUBES

An electron beam tube 17 having a longitudinal axis comprises a first component, such as a ceramic wall 5 and a second component such as a drift tube assembly having a mounting plate 3. The tube further comprises means, such as member 18, arranged to allow relative sliding movement of the first component relative to the second component in a radial direction. The invention helps to alleviate mechanical stresses caused by differential thermal expansion of the components.

(Figure 2a)

1/2

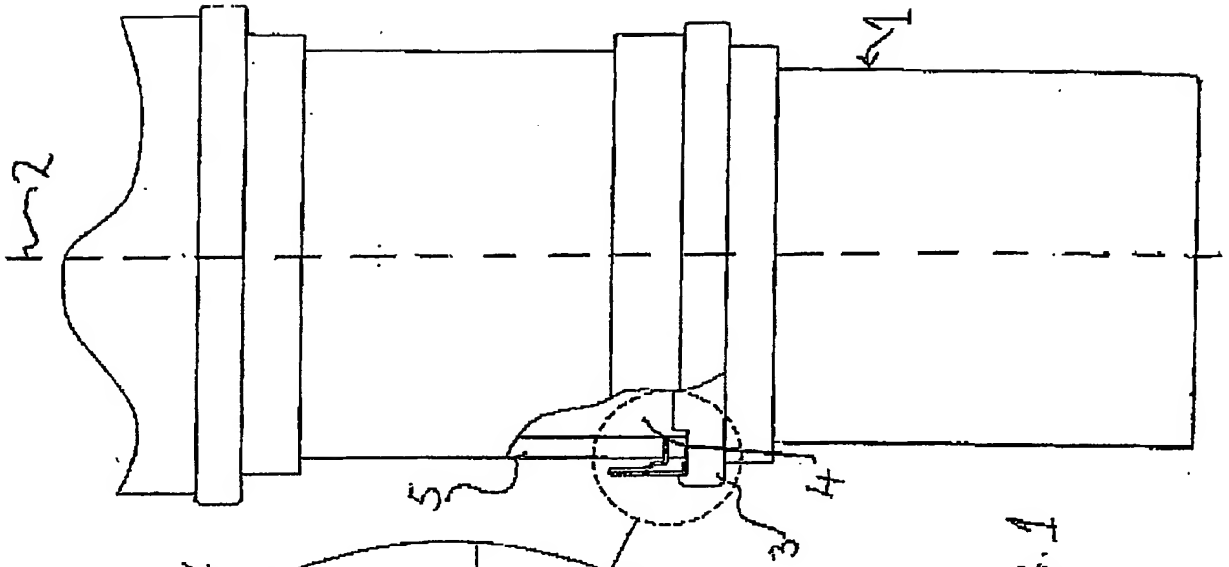

FIG. 1

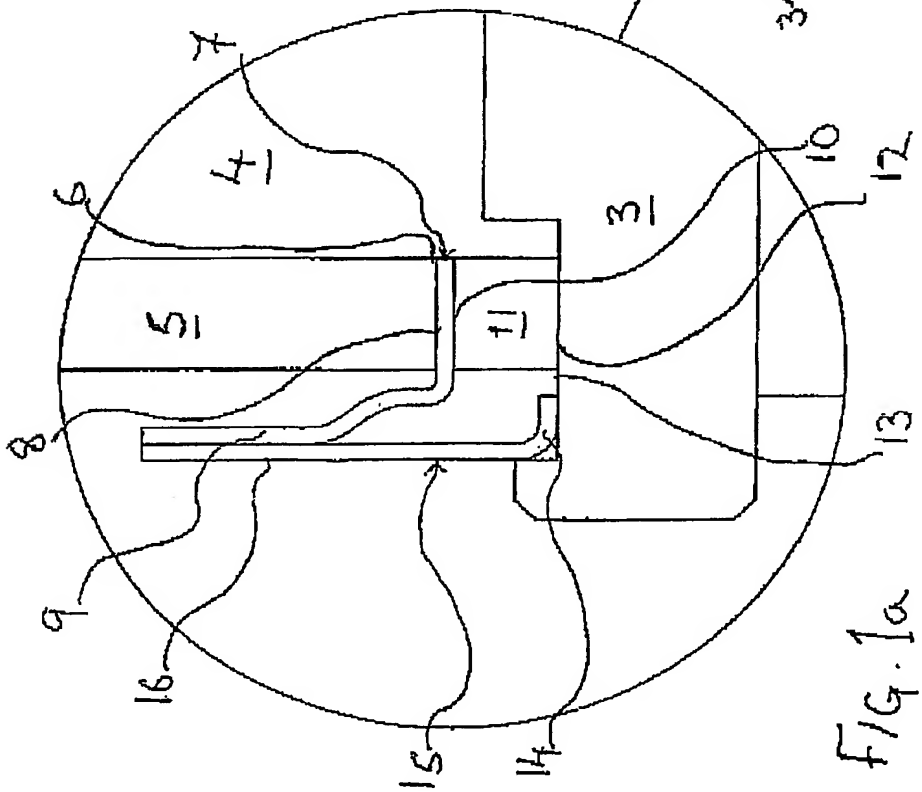

FIG. 1a

2/2

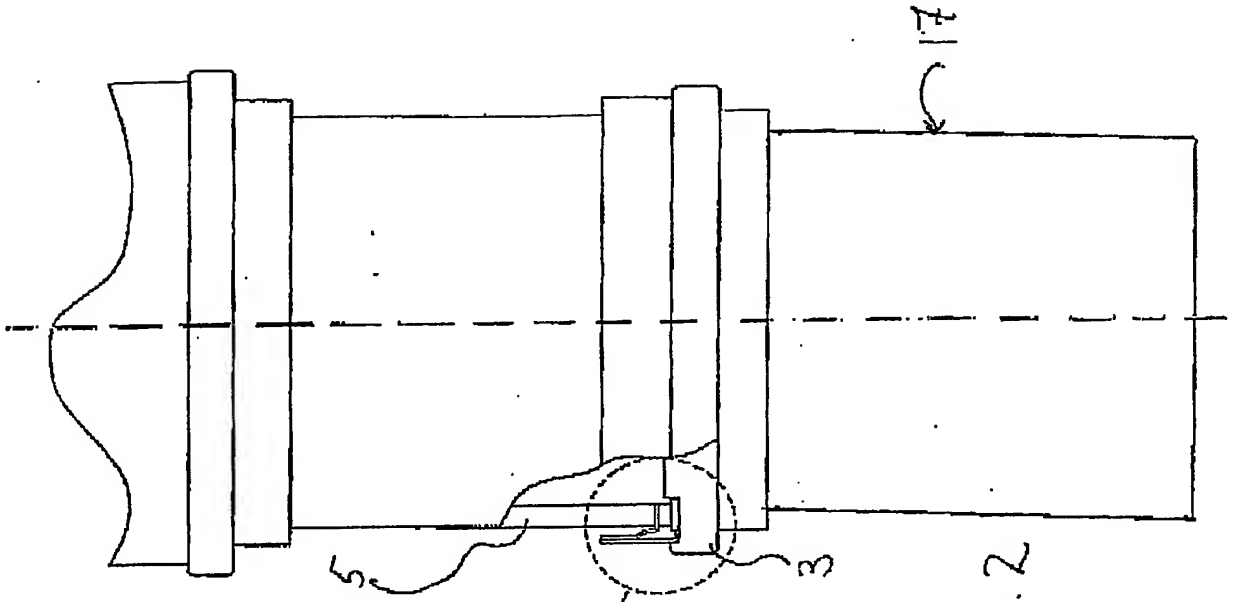

FIG. 2

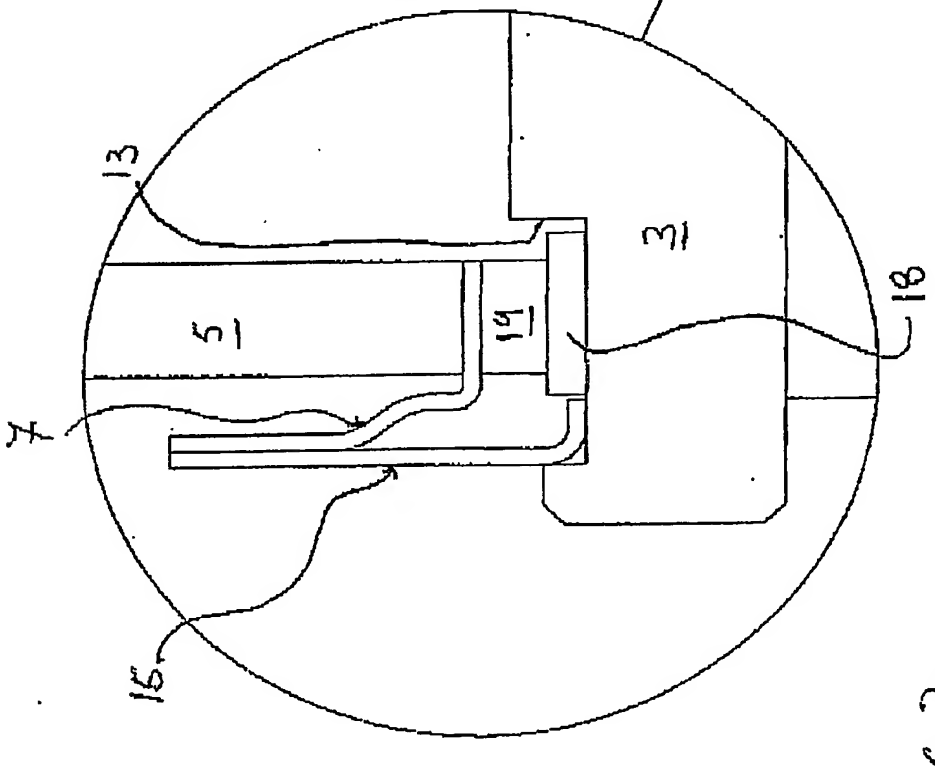

FIG. 2a

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☑ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☑ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.